



Peak Mosquito Activity Times and Trapping for *Culex* sp.

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Acknowledgements

- Mitchell, L. 1981. Time Segregated Mosquito Collections With a CDC Miniature Light Trap. Mosquito News 42: 12-18.
- Abrams, N. and S. Crisp 2001. Tuscola County Mosquitoes and Their Flight Time Dynamics. 2001 MMCA Conference
- Paul Reiter, PhD. Culex Biting Behavior and its Relation to West Nile Virus. 2002 MMCA Conference
- Edward Walker, PhD. Michigan State University

Origin: Study was originally conducted to examine how well traditional adulticiding times coincided with periods of mosquito activity in Michigan. The principles will directly relate to trapping as well.



- Peak flight time at sunset ?
- Most species stop flying around midnight ?
- Cooler temperatures and rain reduce activity ?

Equipment

- Collection Bottle Rotating device
- CDC trap w/50 ohm ballast resistor
- 12 volt sealed rechargeable battery
- 5lb CO₂ tank
- Regulator, metering orifice, tubing
- Hobo temperature and humidity logger

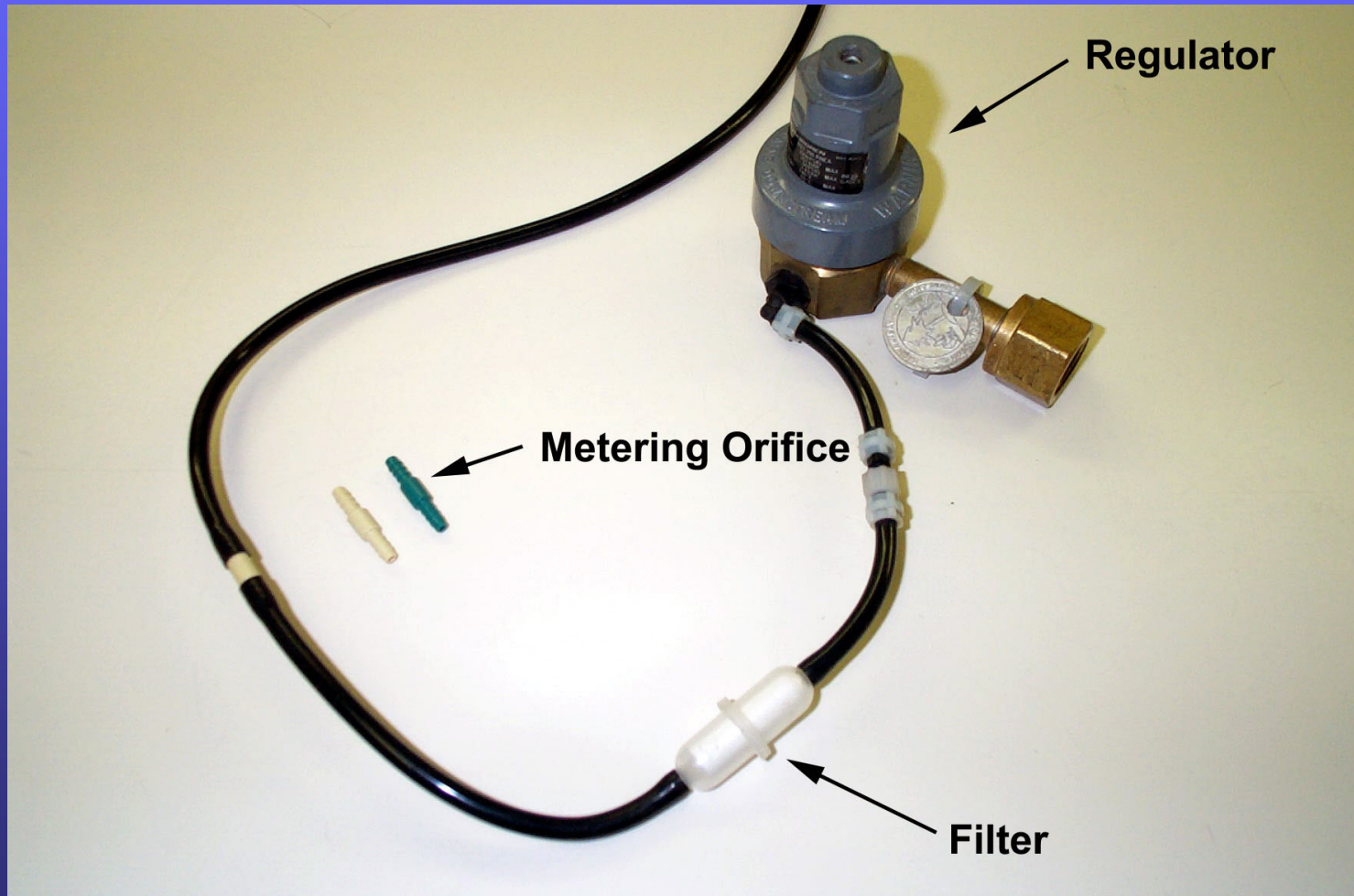


Programmability



- Rotation interval controlled by a programmable timer unit.
- Day of week, on time, off time are variable events

CO₂ Delivery System



Aspects of Tank Delivery

- Constant and consistent release of CO₂ at a rate of 500 ml/minute
- Allowed reproducible bating for all placements
- 5lb tank lasts about 1.5 days
- Larger tank would have been desirable, however, weight becomes a factor in remote placements (Total weight about 15 lbs per tank)
- Tare weight was compared to total weight to judge when a tank needed to be refilled

Weather Data Logging



- Logged temperature
- Logged humidity
- Could be programmed to capture data at any interval coinciding with the trap program
- Allowed easy transfer of records to computer via included cable

Initial Discoveries

- More mosquitoes captured as delivery tube was moved away from fan under the trap lid (CO₂ would get drawn into fan and blown out below the trap if tube was placed too close)
- After sampling spring species using just CO₂, use of a light bulb increased the number of captured summer species (trash insects increased as well)

Placement Strategy

- Logical habitat at the time of season determined trap placements
- Flooded woodlots monitored from late May until mid June for *Ochlerotatus*
- Marshes monitored from late June until mid July for *Cq. perturbans* and *Anopheles*
- *Culex* and *Ae. vexans* habitats monitored from mid July until early September

FW Placements

- Early placements in May yielded low numbers in spite of high landing counts
- Species composition shifted from dark leg *Oc.* to *canadensis* and *stim/fitchii* then captures exploded in number (500/bottle in 3 hours)
- Six placements from June 3 to June 18 captured the highest amount of mosquitoes

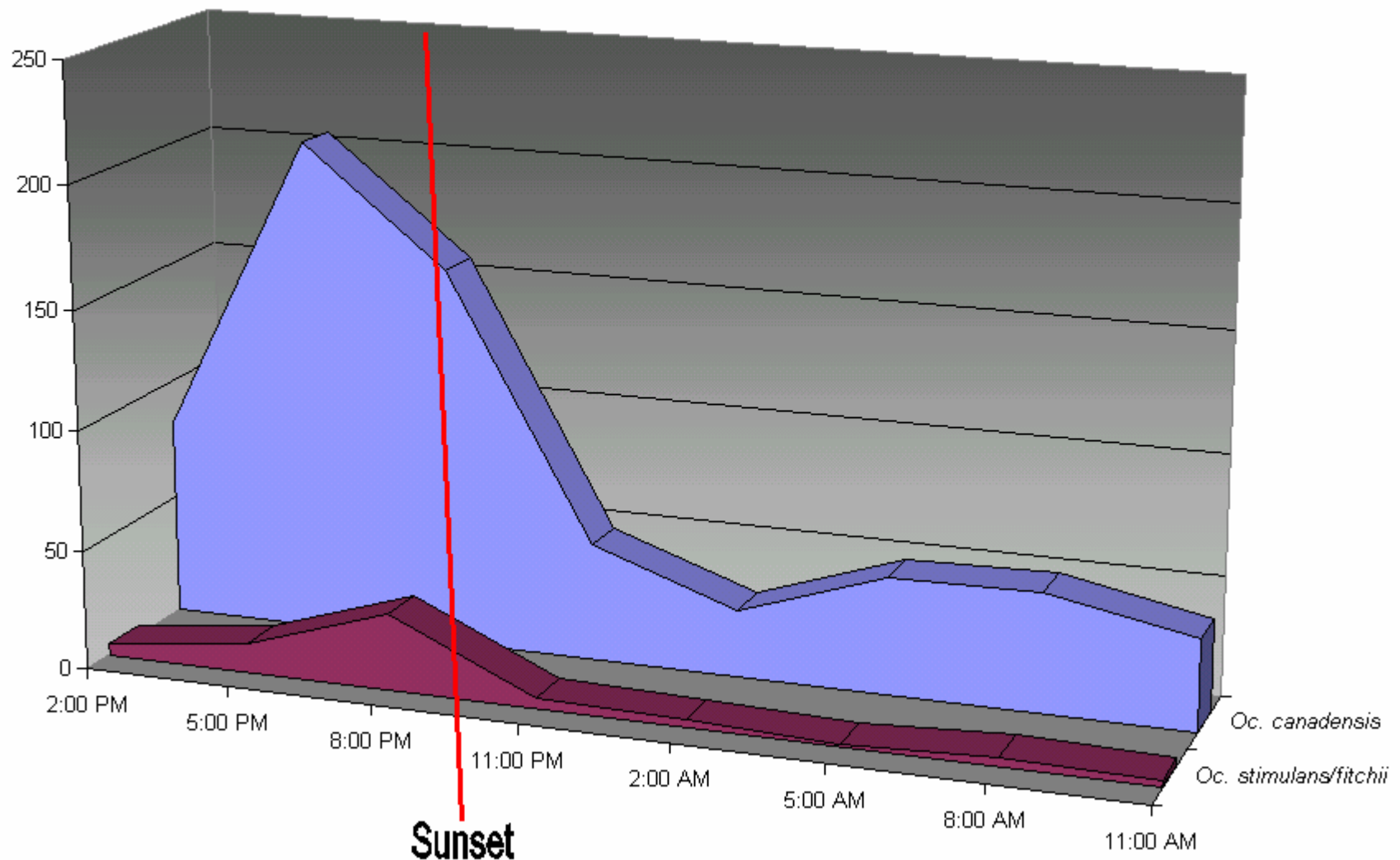
FW Placements

- High activity was observed during an entire 24 hour period (Low bottle counts greater than 25 mosquitoes/bottle)
- Decision to run trap at a 3 hour interval over 24 hours was made

$$24 \text{ hours} / 8 \text{ Bottles} = 3 \text{ hour interval}$$

Spring *Ochlerotatus* Results

Mean Number of Spring *Ochlerotatus* Species Captured Over a 24 Hour Period:
June 3 to June 18

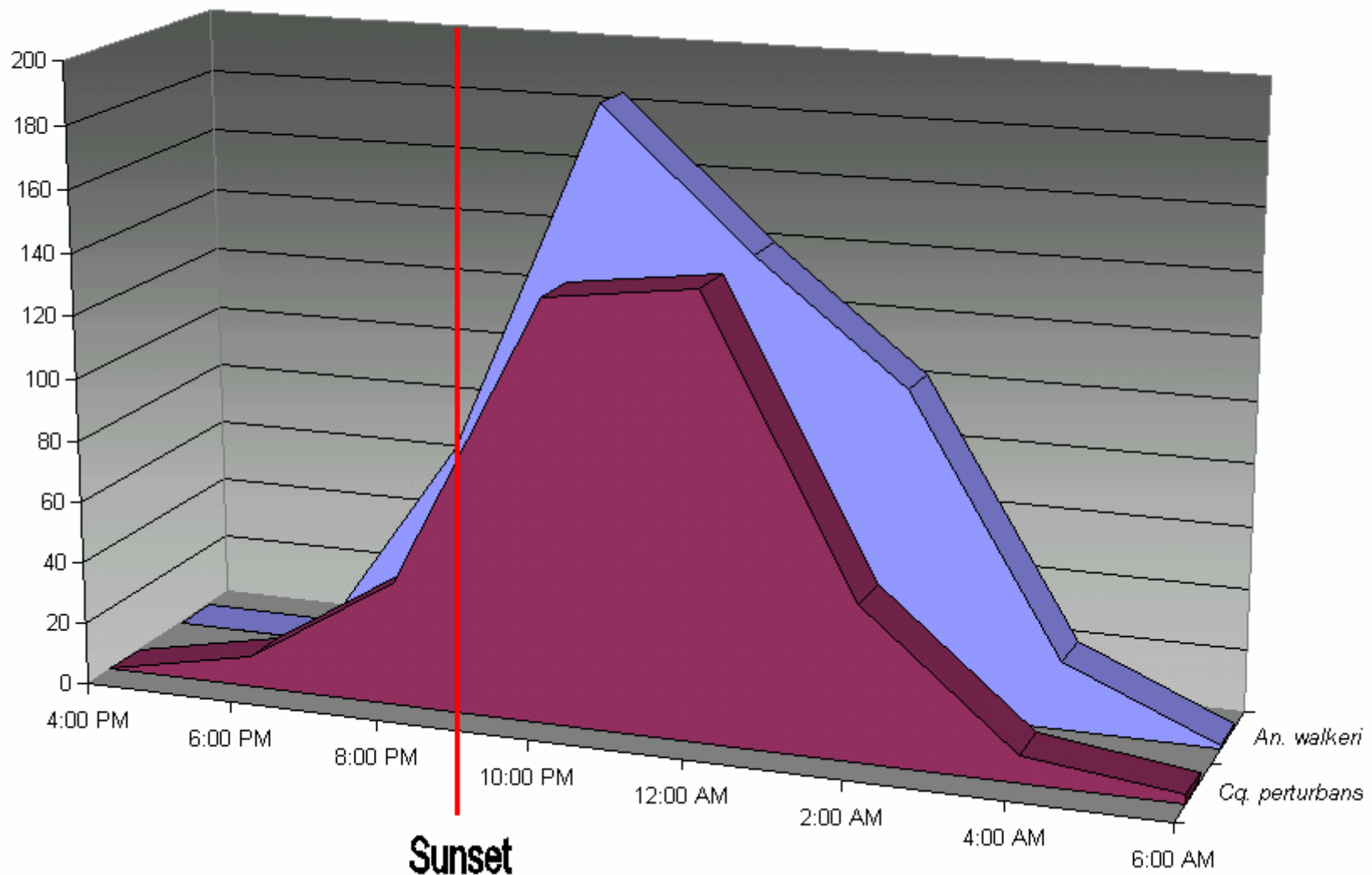


Marsh and Permanent Water Sites

- Captured mosquitoes predominately *Cq. perturbans* and *An. walkeri* ranging in number from 700 to 0/bottle depending on time of day with sharp drop of activity from 8am to 4pm
- Decision made to run at a rotation interval of 2 hours/bottle over a 16 hour period
- Seven Placements from July 2 to July 18

Permanent Water Species Results

Mean Number of *An. walkeri* and *Cq. perturbans* Captured During a 16 Hour Period:
July 2 to July 18

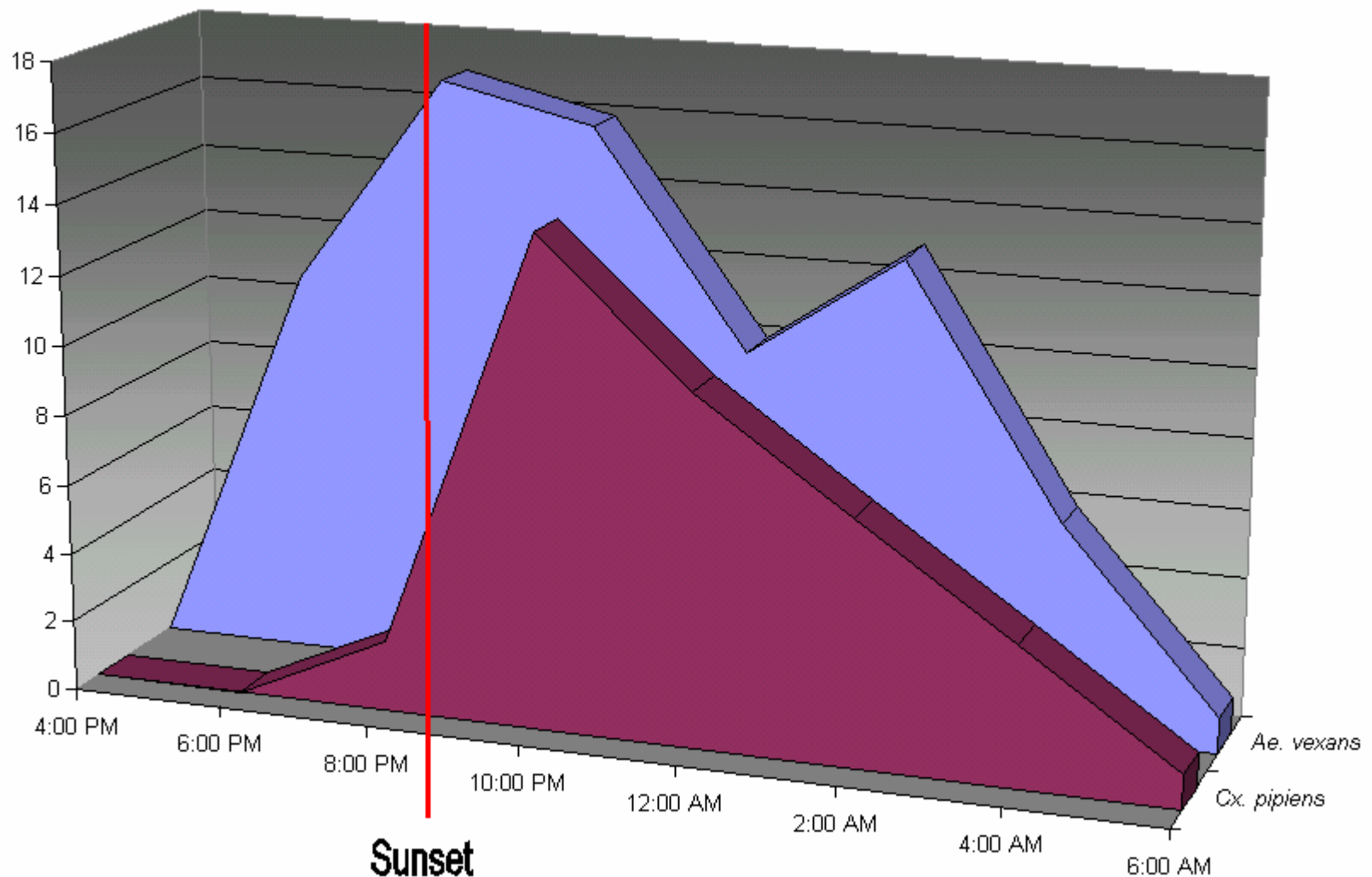


Flood Water and *Culex* Species

- Monitored at sewage lagoons and flooded fields
- Two species were caught together and subsequently grouped together for convenience
- Number of captures tapered off considerably between 8am and 4pm
- Decision to run at 2 hour interval over 16 hours
- 12 Placements July 18 – August 29

Flood Water and *Culex* Results

Mean Number of *Ae. vexans* and *Cx. pipiens* Captured During a 16 Hour Period:
July 18 to August 29



Impact of Temperature and Humidity

- Most placements stayed above 55° as a nightly low.
- Most dramatic temperature impact occurred with *An. walkeri*.
- Brief (less than 1 hour) rain events had minimal impact on capture amounts.
- Deployments with higher humidity coincided with higher amounts of mosquitoes.

The *Culex* Problem

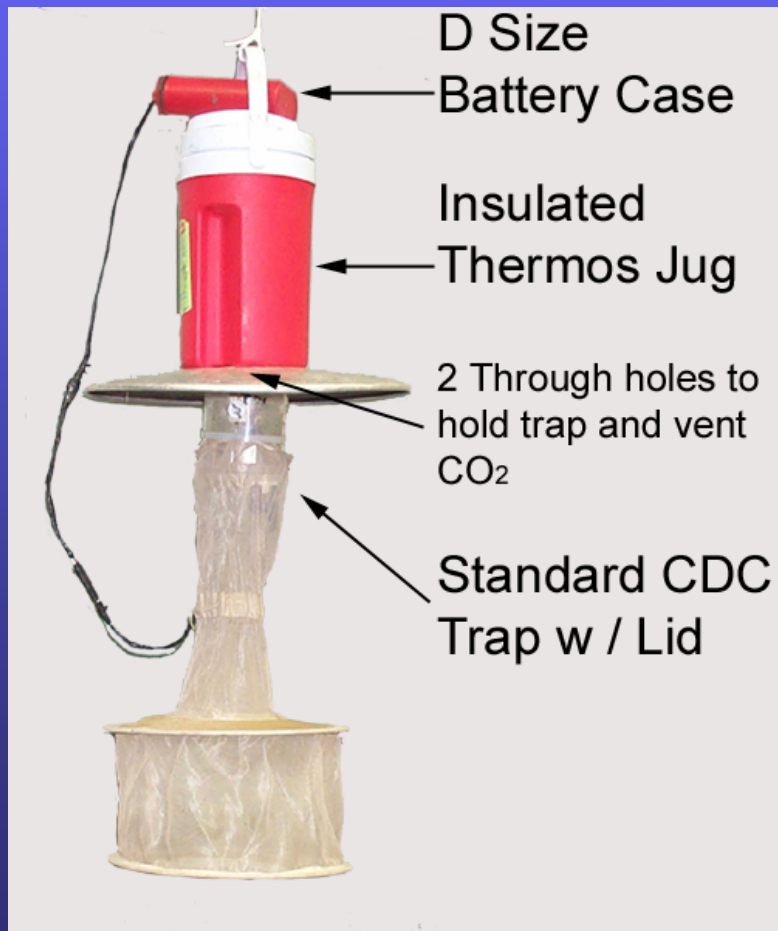
- Despite placements in ideal *Culex* habitats, like sewage lagoons producing 100+ larvae/dip, overall numbers were low in the bottles compared to other species.
- Why?
- Where were the adults?

Elevated Traps



- Previous studies suggested that *Culex* migrate to the canopy to seek birds for a blood meal
- Traps were placed in tandem at 5 feet and 25-30 feet to test this idea

Components of an Elevated Trap



Parts were relatively light in weight

Traps could be constructed from an existing CDC quickly and cheaply

Each thermos jug held about 2 lbs. of dry ice which lasted about 16 hours.

Results of Elevated Traps

<u>Location</u>	<u>Date</u>	<u>Elev.</u>	<u>Amount & Species</u>	<u>Canopy Desc.</u>
Birch Run Sewage Lagoon	7/16/02	High	216-Cx. pipiens	Continuos
Birch Run Sewage Lagoon	7/16/02	Low	39-Cx. pipiens 55-Ae. vexans	Continuos
Birch Run Sewage Lagoon	7/17/02	High	78-Cx. pipiens	Continuos
Birch Run Sewage Lagoon	7/17/02	Low	36-Cx. pipiens 22-Ae. vexans	Continuos
2368 Plainview (Saginaw)	7/24/02	High	308-Cx. pipiens	Isolated Tree
5328 Sherman (Zilwaukee)	7/24/02	High	456-Cx. pipiens	Isolated Tree
3558 Polk (Zilwaukee)	7/31/02	High	334-Cx. pipiens	Isolated Tree
3558 Polk (Zilwaukee)	8/02/02	High	499-Cx. pipiens	Isolated Tree
8050 Edgewood (Birch Run)	8/09/02	High	196-Cx. pipiens	Isolated Tree
8050 Edgewood (Birch Run)	8/09/02	Low	75-Cx. pipiens	Isolated Tree

Results of Elevated Traps - continued

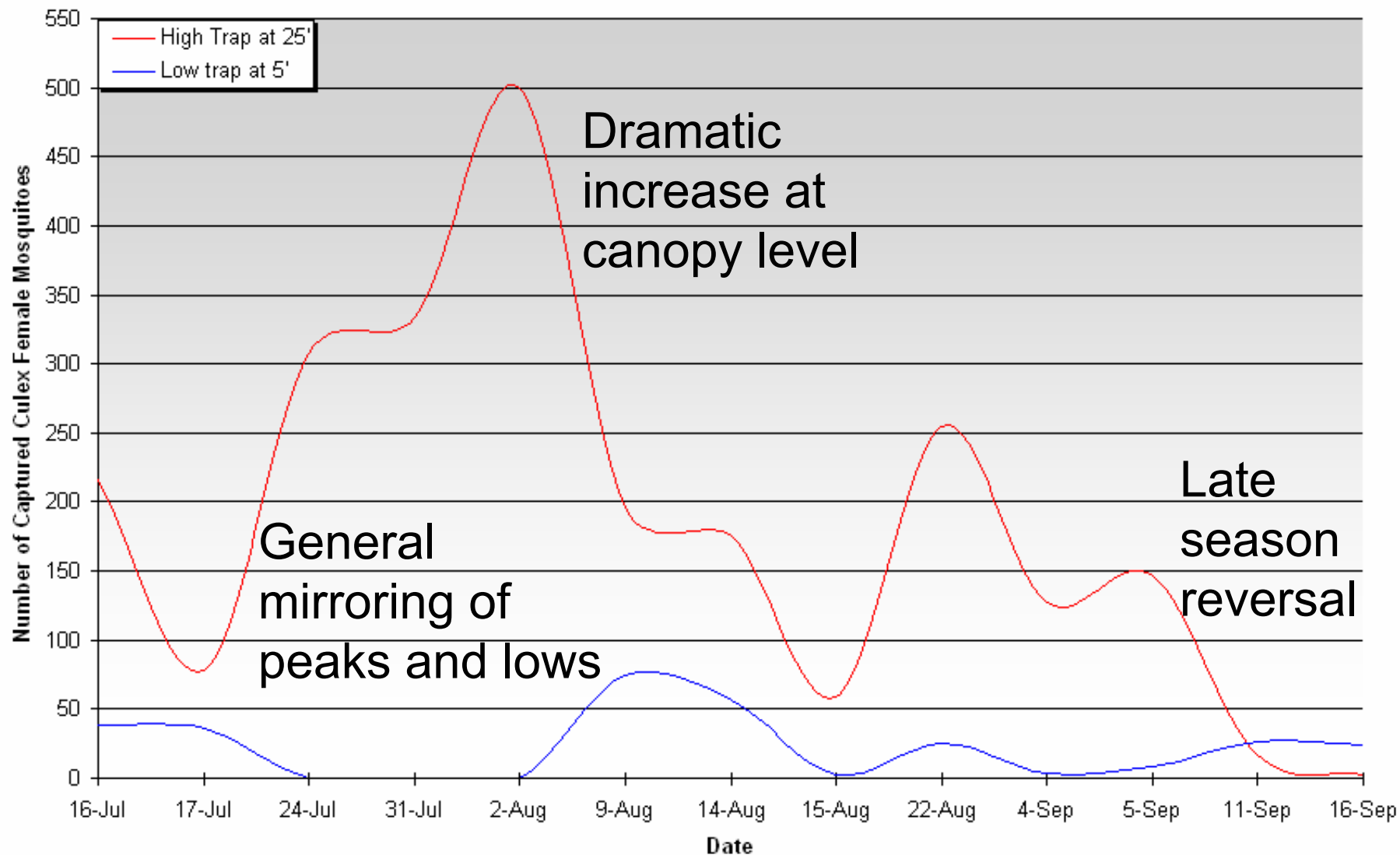
Birch Run Sewage Lagoon	8/14/02	High	175-Cx. pipiens	Continuos
Birch Run Sewage Lagoon	8/14/02	Low	57-Cx. pipiens	Continuos
Birch Run Sewage Lagoon	8/15/02	High	59-Cx. pipiens	Continuos
Birch Run Sewage Lagoon	8/15/02	Low	2-Cx. pipiens	Continuos
3558 Polk (Zilwaukee)	8/22/02	High	254-Cx. pipiens	Isolated Tree
3558 Polk (Zilwaukee)	8/22/02	Low	25-Cx. pipiens 2-An. punctipennis	Isolated Tree
Birch Run Sewage Lagoon	9/04/02	High	127-Cx. pipiens	Continuos
Birch Run Sewage Lagoon	9/04/02	Low	8-Ae. vexans 4- Cx. pipiens 1-Oc. triseriatus	Continuos
3311 Jefferson	9/05/02	High	146-Cx. pipiens	Isolated Tree
3311 Jefferson	9/05/02	Low	9-Cx. pipiens	Isolated Tree

Results of Elevated Traps – The Shift

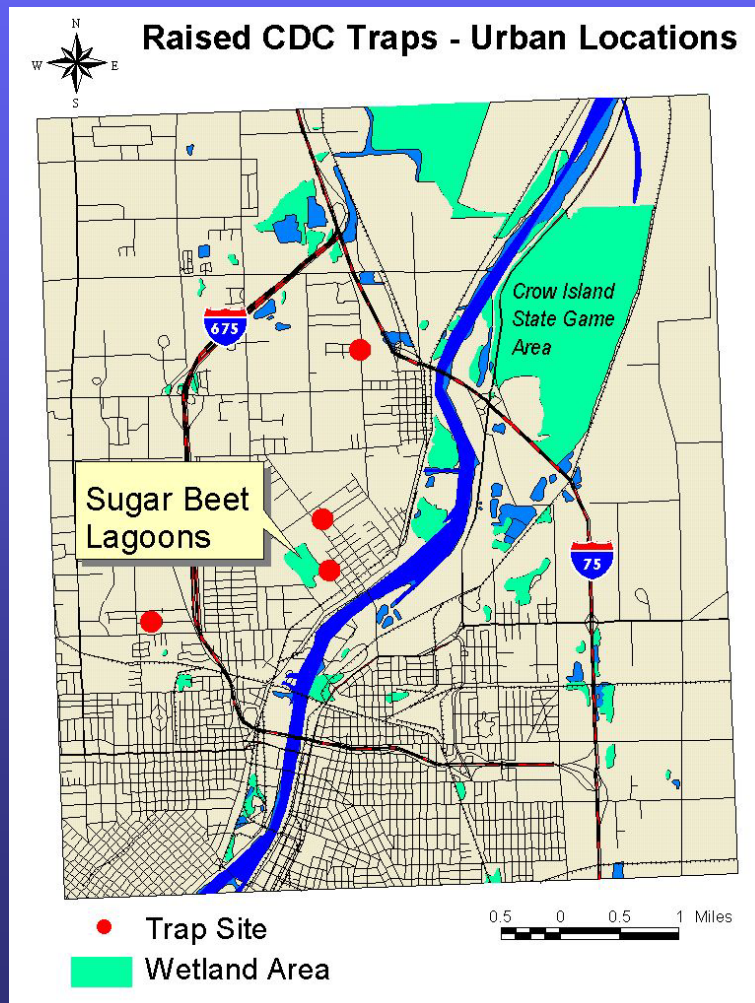
<u>Location</u>	<u>Date</u>	<u>Elv.</u>	<u>Amount & Species</u>	<u>Canopy Desc.</u>
St. Charles Sewage Lagoon	9/11/02	High ¹	17-Cx. pipiens	Continuos
St. Charles Sewage Lagoon	9/11/02	High ²	23-Cx. pipiens 1-An. quadrimac	Isolated Tree
St. Charles Sewage Lagoon	9/11/02	Low ¹	27-Cx. pipiens	Continuos
St. Charles Sewage Lagoon	9/11/02	Low ²	28-Cx. pipiens 11-An. quadrimac	Isolated Tree
Birch Run Sewage Lagoon	9/16/02	High	2-Cx. pipiens 1- An. punctipennis	Continuos
Birch Run Sewage Lagoon	9/16/02	Low	24-Cx. pipiens	Continuos

Summary of *Culex* Activity vs. Elevation

Culex Activity Over Time at Two Elevations



Highest Catches Found in Isolated Tree / Urban Placements



- Do *Culex* disperse more in a continuous canopy?
- Do they concentrate more on isolated trees when less canopy is available?

Tracking the Late Season Shift

- If Culex numbers continued the spatial shift would they continue to migrate into sewers?
- Modified Gravid traps were placed over top of sewer openings and catch basins to attempt to answer this.
- CO₂ baited CDC's placed inside several catch basins



Modified Gravid Trap Results

- Numbers of captured species were extremely low – Results inconclusive
- Better trap design or location might yield better data
- *Culex* obviously over winter, how do you attract them (entering into such a condition)?

Conclusions

- Spring species flight activity remains high throughout the day compared to other species but peaks at least 1-2 hours before sunset
- *Cq.* and *An. walkeri* flight activity seems to reach a plateau of activity from 10 pm to 2 am.
- Early morning seems to be a significant time during periods of peak *Ae. vexans* activity
- Elevating CDC traps by about 20 feet into the tree canopy will at least double the number of *Culex* captures during the mid to late season. This technique produced results that surpassed all conventional methods for capturing *Culex* including Gravid traps.

Final Note

- The first Culex mosquito collections to test positive from Saginaw county in 2002 were collected from elevated traps.
- Regardless of whether this was due to location or elevation, if you catch more mosquitoes there is a greater chance of catching one that will be WNV positive.